

Abstract

Methods of manufacture and devices for performing active biological operations utilize various structures to advantageously collect and provide charged biological materials to an array of microlocations. In one embodiment, a device includes focusing electrodes to aid in the direction and transport of materials from a collection electrode to an array. Preferably, one or more intermediate transportation electrodes are utilized, most preferably of monotonically decreasing size between the collection electrode and the array, so as to reduce current density mismatches. In another aspect, a flow cell is utilized over devices to provide containment of solution containing materials to be analyzed. Preferably, the volume of the flow cell is more advantageously interrogated through use of relatively large collection and return electrodes, such as where the area of those electrodes relative to the footprint of the flowcell is at least 40%. In yet another embodiment, a first collection electrode is disposed adjacent an array, with a second collection electrode disposed on the at least an opposite portion of the array. Preferably, the combined area of the collection electrodes is a substantial fraction, preferably at least 50 % of the area of the footprint of the flow cell. In yet another embodiment, a concentric ring design is provided. Various flip chip embodiments are disclosed. A preferred embodiment utilizes a relatively small number of components, for example, five components, for a flip chip device. A first substrate includes a via, through which solution flows to the underlying analytical chip, which a sealant between the chip and the first substrate. An overlying flow cell contains the solution. Novel manufacturing techniques are provided for utilizing the via as a shadow mask to constrain the flow of the sealant. A multiple site array system includes a row select and column select, which are preferably memory, and most preferably shift register memory. An improved current output circuit is of the current mirror type and serves to output selected current based upon input from the column select and row select.